RESISTANCE PATTERNS OF LOCAL STRAINS OF *STAPHYLOCOCCUS AUREUS*

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Bacterial resistance to antibiotics has become an increasingly distressing problem over the last few decades (Bosso, 1989). *Staphylococcus aureus* is renowned as an organism able to counteract almost any antibiotic challenge and its history has been one of increasing antibiotic resistance. Relatively recent problems with *Staph. aureus* have been caused by methicillin-resistant *Staph. aureus* (MRSA) owing to the particular contagiousness of such strains, which are gaining an increasing prevalence in hospitals around the world (Boyce, 1990; Brumfitt & Hamilton-Miller, 1989).

The aims of my study were:

Study 1

To determine the prevalence of *Staph. aureus* in Malta.

Study 2

To study the levels of resistance of this organism to various antimicrobial agents, with special importance being given to methicillin resistance, and to determine the level of ß-lactamase production, as one of the main mechanisms of resistance of *Staph. aureus.*

Study 3

To investigate the epidemiology of local MRSA infections and formulate a safety policy for dealing with such infections.

Methodology

Study 1: Survey of *Staph. aureus* infections

The study was conducted from the 1st July to the 30th September, 1991 at the Bacteriology Laboratory at St Luke's Hospital. A record was kept of all the specimens yielding positive bacterial cultures during this three-month period of my study. Results which were positive for *Staph. aureus* (n=150) were placed apart and information as regards social and clinical details, ward/department and nature of specimen were entered for each

culture on a standard form. Specimens originating from the same patient were included only once.

Study 2: Resistance patterns

The *Staph. aureus* cultures were daily collected from the laboratory technicians and bacteriological tests were carried out on them. These included:

- sensitivity testing to a number of antibiotics using the disk diffusion technique and

- testing for ß-lactamase production using test-strips impregnated with nitrocefin, a chromogenic cephalosporin

Study 3: Epidemiology of MRSA infections

Whenever an MRSA infection was encountered, the Authorities at the Bacteriology Laboratory were informed immediately and these in turn informed the hospital authorities. Immediate action was taken: the MRSA patient was isolated and effective hygenic measures were implemented. Routine visits to the affected wards were performed in order to screen the staff and take environmental swabs. These swabs were processed on a selective medium in order to test for the presence of MRSA.

RESULTS

Study 1

1. The prevalence of *Staph. aureus* isolates was found to be 6.4% and this was low compared to that of other bacterial isolates e.g. *Pseudomonas* (11.0%) and *Streptococcus* (31.1%) isolated during the same period.

2. The prevalence of *Staph. aureus* isolates, as analyzed in various wards in St Luke's Hospital, other hospitals and the community, was found to range between 2.2% in intensive care units and 10.9% at Boffa Hospital. Excluding the intensive care wards where the prevalence of *Staph. aureus* was extremely low, no statistically significant difference could be detected betwen the prevalence of *Staph. aureus* in the various wards/departments.

3. As regards nature of specimen, the prevalence of *Staph. aureus* was highest in pus specimens (20.9%) and this proved to be significantly higher than that in sputum, urine, blood and other specimens ($p<0.001$). The high prevalence of *Staph. aureus* in pus specimens when compared to other micro-organisms was expected owing to the propensity of the organism to infect wounds, burns and diabetic ulcers - these constituted the major clinical conditions giving rise to pus specimens.

4. The occurence of *Staph. aureus* infections decreased slightly from the first (0-4 years) to the second age group (5-12 years) but then increased steadily with advancing age. This shows that *Staph. aureus* infections occurred at a higher frequency at the extremes of life due to the higher susceptibility of such patients to infection.

Study 2

1. Resistance rates of local strains of *Staph. aureus* were found to be low compared to other national studies (Turnridge et al, 1989). Out of the 9 antibiotics tested for, resistance rates were highest with erythromycin (14.7%) followed by gentamicin (11.3%). Sensitivity was highest with vancomycin and clavulanate - potentiated amoxycillin.

   ß-lactamase production was found in 60% of the strains tested.

2. Resistance rates and ß-lactamase production were found to be higher in hospital than in community strains of *Staph. aureus*.

3. The prevalence of resistant strains was found to be highest in intensive care units when comparisons were made to all other wards/departments. The same observation was also made for the prevalence of MRSA.

4. Resistance rates were always higher in MRSA when compared to MSSA (methicillin - sensitive) strains. Significant differences were observed with clindamycin ($p < 0.05$), erythromycin and gentamicin ($p < 0.001$). ß-lactamase production was also found to be significantly higher in MRSA when compared to MSSA ($p < 0.001$), and this lies in agreement with other studies (Watanabe et al, 1987).

5. More than one third of *Staph. aureus* infections consisted of mixed infections, the most common accompanying pathogens being *Streptococcus* and members of the *Enterobacteriaceae*. Resistance patterns of these organisms were not however taken into account.

Study 3

During the study period, 11 patients were found to be infected with MRSA and in three of these cases, an MRSA reappeared within the same ward within an interval of one month, thus suggesting the spread of the staphylococcus via fomites.

Screening tests on 83 staff members showed a low staphylococcal nasal carriage rate of 21.7%, when compared to the normal 30%. Only 2 of these were found to be nasal carriers of MRSA, but they were defined as being transient carriers (Pearman et al, 1985).

Environmental cultures gave no positive results.

In view of the above and of the reported serious consequences of MRSA, ä policy for dealing with such infections has been postulated.

Conclusion

The problem of resistance with the local strains of *Staph. aureus* is much less than abroad. This also applies for resistance to methicillin which was found to be 7.3%, and not of the epidemic type. MRSA strains in Malta occur only as occasional sporadic isolates which rarely cause cross-infection following isolation of the patient. Even the degree of multiresistance in MRSA is not so high so that an antibiotic can always be chosen for treatment without the need to resort to vancomycin.

However, despite lack of the problem, the issuing of a safety policy for dealing with MRSA infections is felt to be urgent in order to keep the situation in check and prevent the epidemic MRSA from becoming established in the Maltese hospitals. The pharmacist, as a member of the Infection Control Team, has an important role to play in this area mainly by creating a level of awareness among staff about the serious problems that can be caused by an epidemic MRSA, organising ward screening programmes of patients and staff, and ensuring that appropriate isolation and hygenic precautions are being taken.

In the battle against MRSA, co-operation between all health care professionals is necessary and the aim should be one of 'Prevention rather than Cure'.

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